Serial No. 09/800,905
Docket No. NEG-199 US

AMENDMENTS TO THE CLAIMS:

1. (Previously presented) A cross-bar switch system with redundancy having a cross-bar switch set of a redundant structure, comprising:

a plurality of cross-bar switches for effecting connections between nodes of a plurality of nodes; and

at least one additional redundant cross-bar switch, wherein:

(a) a first cross-bar switch of said cross-bar switch set receives at input terminals thereof, first outputs among multiple N outputs of each of the plurality of nodes, and said one redundant cross-bar switch receives Nth outputs among N outputs of each of said plurality of nodes applied to input terminals thereof, N being an integer of 2 or more;

(b) each of remaining cross-bar switches includes M selection circuits, each of which receives two consecutive outputs of an order corresponding to that of the cross-bar switch, among N outputs of each of said plurality of nodes, the outputs of these M selection circuits being input to the cross-bar switch, M being an integer of 2 or more;

(c) each node of said plurality of nodes includes N selection switches, which are provided at input terminals thereof, each of said selection switches receives two consecutive outputs of an output order corresponding to that of the node, among outputs of two mutually adjacent cross-bar switches, two by two, of said cross-bar switch set; and

(d) in response to a selection control signal output from a failure processing circuit that executes cross-bar switch failure processing, each of said selection circuits selects and outputs one of its two inputs and, when one cross-bar switch fails, takes the failed cross-bar switch out of service.

2. (Currently amended) A cross-bar switch system with redundancy, ~~comprising:~~ comprising N+1 cross-bar switches, wherein:

(a) one cross-bar switch is redundantly provided, in addition to N cross-bar switches required for connecting of nodes among first to Mth nodes where M and N are prescribed integers equal to or greater than 2, respectively;

(b) the first cross-bar switch receives each first output among N outputs of each of said first to Mth nodes at M input terminals thereof;

(c) the (N+1)th cross-bar switch receives each Nth output among N outputs of each of said first to Nth nodes at M input terminals thereof;

(d) an Ith, where I is an integer of 2 or more and less than N, cross-bar switch having M selection circuits, which are provided at respective ones of M input terminals thereof, to each of which are input consecutive (I-1)th and Ith outputs, which correspond to said Ith cross-bar switch, among outputs of each of said first to Mth nodes;

(e) a Jth, where J is an integer of 1 or more and not more than M, node having N selection switches, which are provided at input terminals of said node, to each of which are input Jth outputs of two mutually adjacent cross-bar switches among said first to (N+1)th cross-bar switches, where N is an integer of 2 or more; and

(f) in response to a selection control signal output from a failure processing circuit that executes cross-bar switch failure processing, each of said selection circuits selects and outputs one of its two inputs and, when one cross-bar switch fails, takes the failed cross-bar switch out of service.

3. (Currently amended) A cross-bar switch system with redundancy, ~~comprising:~~ comprising N+1 cross-bar switches, wherein:

(a) one cross-bar switch is redundantly provided, in addition to N cross-bar switches

required for connecting of nodes among first to Mth nodes, where M and N are prescribed integers of 2 or more, respectively;

(b) each node of said first to Mth nodes outputting first to Mth output signals from output terminals thereof and receiving first to Nth input signals applied to input terminals thereof;

(c) the first cross-bar switch receiving each first output signal of each of said first to Mth nodes at M input terminals thereof;

(d) the (N+1)th cross-bar switch receiving each Nth output signal of each of said first to Mth nodes at M input terminals thereof;

(e) an Ith, where I is an integer of 2 or more and not more than N, cross-bar switch having M selection circuits, which are provided at respective ones of M input terminals thereof, to each of which are input two signals, namely an (I-1)th output signal and an Ith output signal, of each of said first to Mth nodes;

(f) a Jth, where J is an integer of 1 or more and not more than M, node having N selection circuits, which are provided at N input terminals thereof, to each of which are input outputs of a Jth output port of each of mutually adjacent cross-bar switches among said first to (N+1)th cross-bar switches, namely of Kth and (K+1)th cross-bar switches, where K is an integer of 1 or more and not more than N; and

(g) in response to a selection control signal output from a failure processing circuit that executes cross-bar switch failure processing, each of said selection circuits selects and outputs one of two signals and, when one cross-bar switch fails, takes the failed cross-bar switch out of service.

4. (Previously presented) In a system having cross-bar switches for connecting Central Processing Units (CPUs) and a memory within a computer system or for connecting nodes in

a computer system composed of a plurality of nodes, a cross-bar switch system with redundancy comprising:

(a) N+1 cross-bar switches inclusive of N cross-bar switches and one redundant cross-bar switch;

(b) selection circuits provided at inputs and outputs of said cross-bar switches; and

(c) means, operable when the system fails, for performing control in such a manner that a cross-bar switch that has failed is taken out of service and the redundant cross-bar switch is placed in service by controlling said selection circuits by a failure processing circuit after the system is restarted, said failure processing circuit recognizing that said cross-bar switch has failed, each of said selection circuits selects and outputs one of its two inputs and, when one cross-bar switch fails, takes the failed cross-bar switch out of service.

5. (Original) The system according to claim 3, wherein each of said nodes inputs and outputs N bytes of data on a byte-by-byte basis.

6. (Previously presented) The system according to claim 1, wherein said failure-processing circuit comprises:

an (N+1)-bit cross-bar switch failure information register for storing whether failure has occurred or not with regard to said first to (N+1)th cross-bar switches;

a selection-circuit control output circuit for outputting a selection control signal to each of said selection circuits based upon values in said cross-bar switch failure information register; and

a multiple-failure detector for informing a system controller of occurrence of multiple failure when multiple cross-bar switches fail.

7. (Previously presented) The system according to claim 2, wherein said failure-processing circuit comprises:

an (N+1)-bit cross-bar switch failure information register for storing whether failure has occurred or not with regard to said first to (N+1)th cross-bar switches;

a selection-circuit control output circuit for outputting a selection control signal to each of said selection circuits based upon values in said cross-bar switch failure information register; and

a multiple-failure detector for informing a system controller of occurrence of multiple failure when multiple cross-bar switches fail.

8. (Previously presented) The system according to claim 3, wherein said failure-processing circuit comprises:

an (N+1)-bit cross-bar switch failure information register for storing whether failure has occurred or not with regard to said first to (N+1)th cross-bar switches;

a selection-circuit control output circuit for outputting a selection control signal to each of said selection circuits based upon values in said cross-bar switch failure information register; and

a multiple-failure detector for informing a system controller of occurrence of multiple failure when multiple cross-bar switches fail.

9. (Previously presented) The system according to claim 4, wherein said failure-processing circuit comprises:

an (N+1)-bit cross-bar switch failure information register for storing whether failure has occurred or not with regard to said first to (N+1)th cross-bar switches;

a selection-circuit control output circuit for outputting a selection control signal to

each of said selection circuits based upon values in said cross-bar switch failure information register; and

a multiple-failure detector for informing a system controller of occurrence of multiple failure when multiple cross-bar switches fail.

10. (Previously presented) The system according to claim 1, wherein said cross-bar switches connect Central Processing Units (CPUs) and a memory within a computer, or perform switching between nodes of a multinode system having CPUs and memories, wherein the memories of remote nodes are accessed via the cross-bar switches.

11. (Previously presented) The system according to claim 2, wherein said cross-bar switches connect Central Processing Units (CPUs) and a memory within a computer, or perform switching between nodes of a multinode system having CPUs and memories, wherein the memories of remote nodes are accessed via the cross-bar switches.

12. (Previously presented) The system according to claim 3, wherein said cross-bar switches connect Central Processing Units (CPUs) and a memory within a computer, or perform switching between nodes of a multinode system having CPUs and memories, wherein the memories of remote nodes are accessed via the cross-bar switches.

13. (Previously presented) The system according to claim 4, wherein said cross-bar switches connect Central Processing Units (CPUs) and a memory within a computer, or perform switching between nodes of a multinode system having CPUs and memories, wherein the memories of remote nodes are accessed via the cross-bar switches.

14. (Previously presented) The system according to claim 6, wherein said cross-bar switches connect Central Processing Units (CPUs) and a memory within a computer, or perform switching between nodes of a multinode system having CPUs and memories, wherein the memories of remote nodes are accessed via the cross-bar switches.

15. (Original) The system according to claim 1, wherein M and N are equal values.

16. (Original) The system according to claim 2, wherein M and N are equal values.

17. (Previously presented) The system according to claim 3, wherein M and N are equal values.

18. (Currently amended) A cross-bar switch system with redundancy having a cross-bar switch set of a redundant structure, said cross-bar switch system comprising:

a plurality of cross-bar switches that provide connections between nodes of a plurality of nodes and including selection circuits, each said cross-bar switch receiving two inputs; and

at least one additional redundant cross-bar switch,

wherein, in response to a selection control signal output from a failure processing circuit that executes cross-bar switch failure processing, each of said selection circuits selects and outputs one of its two inputs and, when one of said cross-bar switches fails, takes the failed cross-bar switch out of service.

19. (Previously presented) A method of providing redundancy in a cross-bar switch system, said method comprising:

providing a plurality of cross-bar switches for effecting connections between nodes of

a plurality of nodes; and

providing at least one additional redundant cross-bar switch, wherein:

(a) a first cross-bar switch of said cross-bar switch set receives at input terminals thereof, first outputs among multiple N outputs of each of the plurality of nodes, and said one redundant cross-bar switch receives Nth outputs among N outputs of each of said plurality of nodes applied to input terminals thereof, N being an integer of 2 or more;

(b) each of remaining cross-bar switches includes M selection circuits, each of which receives two consecutive outputs of an order corresponding to that of the cross-bar switch , among N outputs of each of said plurality of nodes, the outputs of these M selection circuits being input to the cross-bar switch, M being an integer of 2 or more;

(c) each node of said plurality of nodes includes N selection switches, which are provided at input terminals thereof, each of said selection switches receives two consecutive outputs of an output order corresponding to that of the node, among outputs of two mutually adjacent cross-bar switches, two by two, of said cross-bar switch set; and

(d) in response to a selection control signal output from a failure processing circuit that executes cross-bar switch failure processing, each of said selection circuits selects and outputs one of its two inputs and, when one cross-bar switch fails, takes the failed cross-bar switch out of service.

20. (Currently amended) A method of providing redundancy in a cross-bar switch system, said method comprising:

providing a plurality of cross-bar switches that provide connections between nodes of a plurality of nodes and including selection circuits, each said cross-bar switch receiving two inputs; and

providing at least one additional redundant cross-bar switch,

wherein, in response to a selection control signal output from a failure processing circuit that executes cross-bar switch failure processing, each of said selection circuits selects and outputs one of its two inputs and, when one of said cross-bar switches fails, takes the failed cross-bar switch out of service.